

involves a more complicated mold structure and also requires an assembly operation with the hub. The hub may be formed of plastic, wood, metal, or other material.

In Figs. 1 and 2 the holder may be molded as one piece of rubber to a metallic shaft or spindle which may be knurled or ribbed. It should be observed that these constructions are exceedingly simple to manufacture since the holders may be formed to the final shape with relatively simple molds.

All of the forms of the invention may be driven in either direction. Ordinarily, it will be preferred to drive the holders in the direction in which the arms extend from the more radial portions thereof. With this direction of rotation the drag on the sleeve resulting from the abrasive use thereof will tend to flex the arms in such a manner as to increase the force they exert against the sleeve. When a very soft action is desired, rotation in the opposite direction may be preferred.

It is important to have at least three and preferably four or more arms. With only two arms, very little pressure is required to push the sleeve off center with respect to the axis of the hub.

A salient characteristic of the present holder is its capacity to expand evenly under rotation so as to bear with pressure against the surrounding sleeve. A condition of expansion is normally attained when the holder is in operation, and a condition of relaxation when the holder is still. This makes for security in the connection between the abrasive sleeve and the holder when the device is operated, and for ease in removal of the sleeve and replacement of a substitute sleeve, whenever desired. In addition, the expanded peripheral band of the holder is susceptible of yielding when the sleeve is pressed against the work, so as to enlarge the area of its surface contact therewith. Accordingly, in many cases the time required for performing a given task may be materially reduced or the quality improved.

Successful performance of the present sleeve holder is also attributable to another factor, viz. the form and arrangement of the arms which transmit the rotary force to the surrounding sleeve. These arms, while resilient, are stiff or self-sustaining enough to move the band through its circular path, and not inwardly, the arms for a large part of their length being concentric therewith and adjacent thereto so that centrifugal force works on the arms. The connection between each arm and the band, when a band is provided, is confined to a relatively small area at the arm extremity, leaving the arms and band elsewhere in freely separable relation. This is important in facilitating a uniform and even expansion or outward movement of the band at every point in its periphery when rotation takes place. The band is accordingly free to expand at every peripheral point, even at the arm extremities where connection is made with the band. In every case the holder furnishes a rotatable, floating, yieldable, driving and concentric support for the abrasive sleeve such that it may be easily slipped on and off when motionless, and be flattened somewhat at the point of its engagement with the work whereby to enlarge its area of contact therewith.

It will be observed that in both of Figs. 1 and 2 the arcuate portions of the arms each terminate at its free end in a portion too thick to pass between the adjacent arm and the sleeve and pos-

sibly be gripped between them. It is preferred to have a thickness of about a quarter of the radius of the holder, this thickness in the case of Fig. 1 including the flange 53. It is believed, however, that anything over one-eighth of the radius of the holder would be sufficient. In fact, the flange 53 in Fig. 1 may be omitted entirely with only slight danger of occasional inconvenience due to the gripping of an arcuate portion between the adjacent arm and the sleeve. In all of the forms of the invention the arcuate portions may be impregnated with an abrasive so as to make the addition of an abrasive sleeve unnecessary. However, this abrasive sleeve is preferred since it controls the working dimensions and is inexpensive to replace.

In Fig. 2, the apertures 65 may be omitted, but each slot 64 should desirably extend close to the adjacent slot so that as in the illustrated forms the arcuate portions of the arms will be connected to the hub only by a portion of relatively small cross-section. Particularly, it is desirable that in all forms there be one point between the arcuate portion of the arm and the hub where the connecting material is small in the circumferential direction in keeping with the dimensions marked "a" in Fig. 2. This, together with the free-ended arms, provides a high degree of flexibility and expansibility.

The dimension *a* in Fig. 2 may be increased considerably beyond that shown although some of the advantages of the invention may thereby be lost unless high flexibility of the arms is provided in some other way. At the present time it is preferred that the dimension *a* be approximately as shown, namely, in the order of  $\frac{1}{16}$  of the radius of the holder. One alternative way of providing flexibility of at least the terminal portion of the arm is to move the aperture 65 closer to the circumference as the dimension *a* is increased.

The holder may, of course, be made of synthetic rubber, such as the Buna rubbers, including Buna S, and Neoprene as well as compounds of natural rubber. Any such materials may be deemed to be included in the term "rubber-like" used in the claims, provided that they are flexible, compressible, elastic, and stable at slightly elevated operating temperatures, thus resembling ordinary soft vulcanized rubber.

This application is a division of my application Ser. No. 669,869, filed May 15, 1946, now Patent No. 2,483,422, dated October 4, 1949.

#### I claim:

1. The combination with an abrasive sleeve of an internal holder therefor of molded rubber-like material forming an expansible support for the abrasive sleeve and initially having a diameter greater than that of the sleeve interior, the holder comprising a rotary expanding member including a hub and a plurality of flexible arms carried thereby, extending outwardly from the hub and having portions extending concentrically with the sleeve and spaced from the hub, the concentrically arranged portions of said arms being separated by a narrow gap and free for independent movement in a radial direction.

2. A rotary expanding holder including a hub and a plurality of flexible arms molded integrally therewith of rubber-like material extending outwardly from the hub and independently flexible with respect thereto, and having portions extending concentrically with and spaced from the hub with arcuate surfaces forming a circular peripheral support whose diameter is initially